Generative Adversarial Networks

Slides available at `jonkrohn.com/talks`

March 2nd, 2022

Jon Krohn

Outline

1. Applications
2. Essential Theory
3. “Quick, Draw!” Implementation

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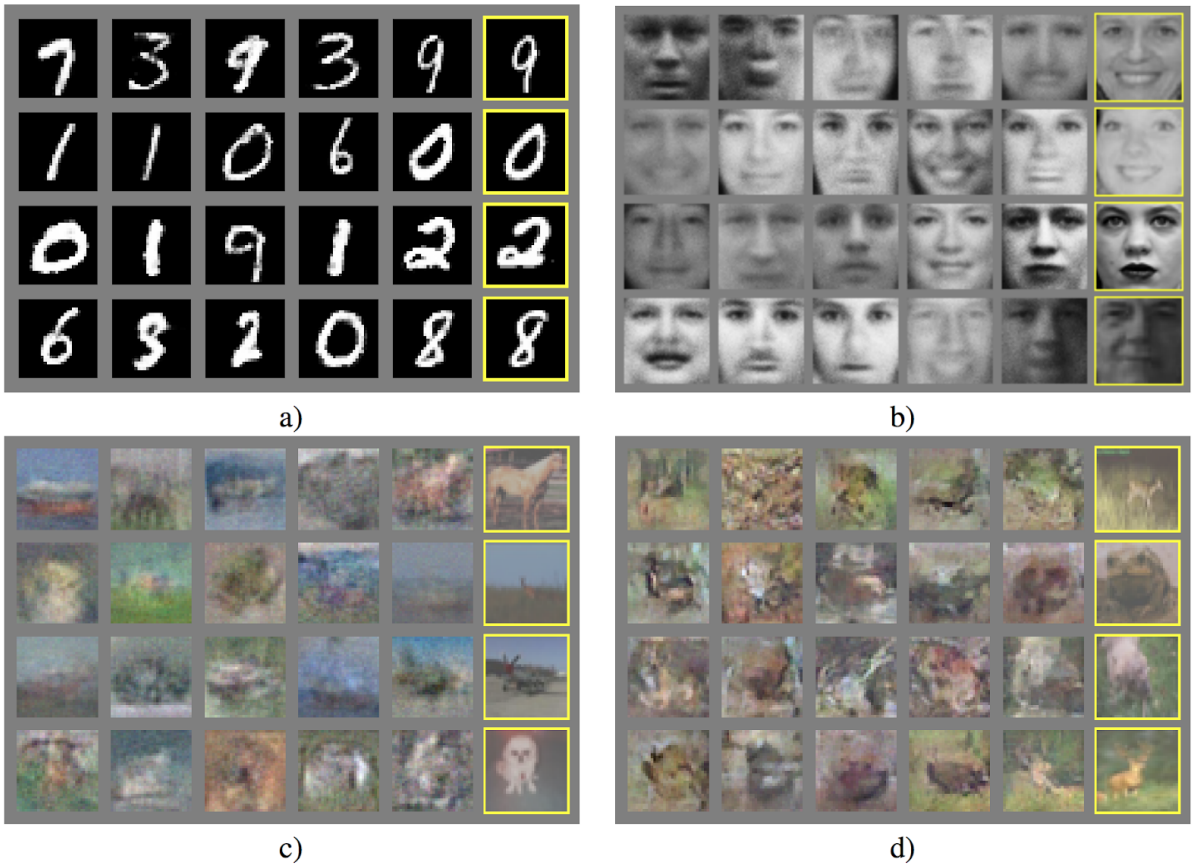
GANs

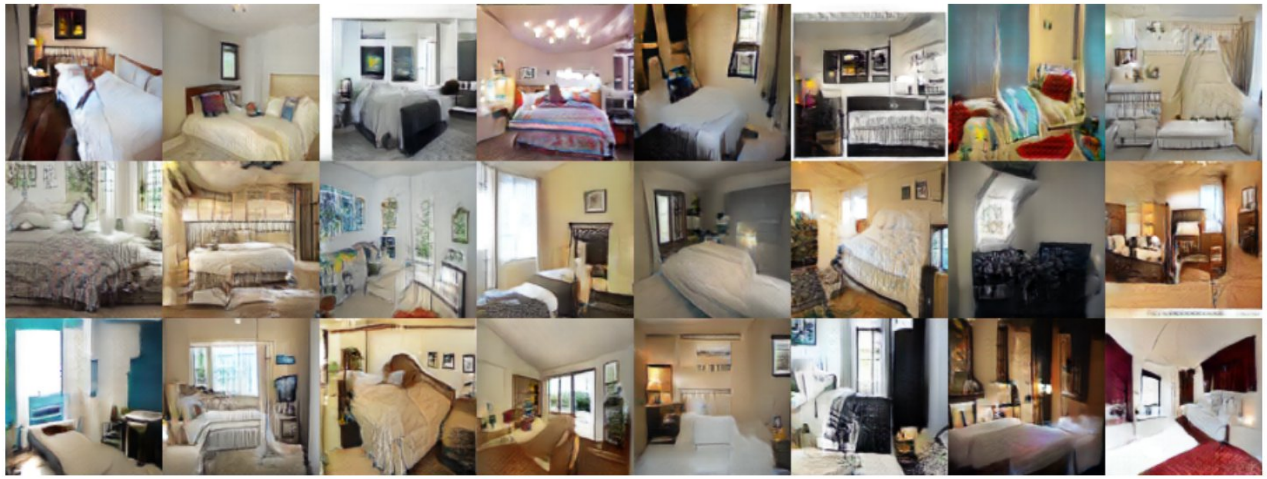
Goodfellow et al. (2014)



a) b) c) d)

DCGANs

Radford et al. (2016)



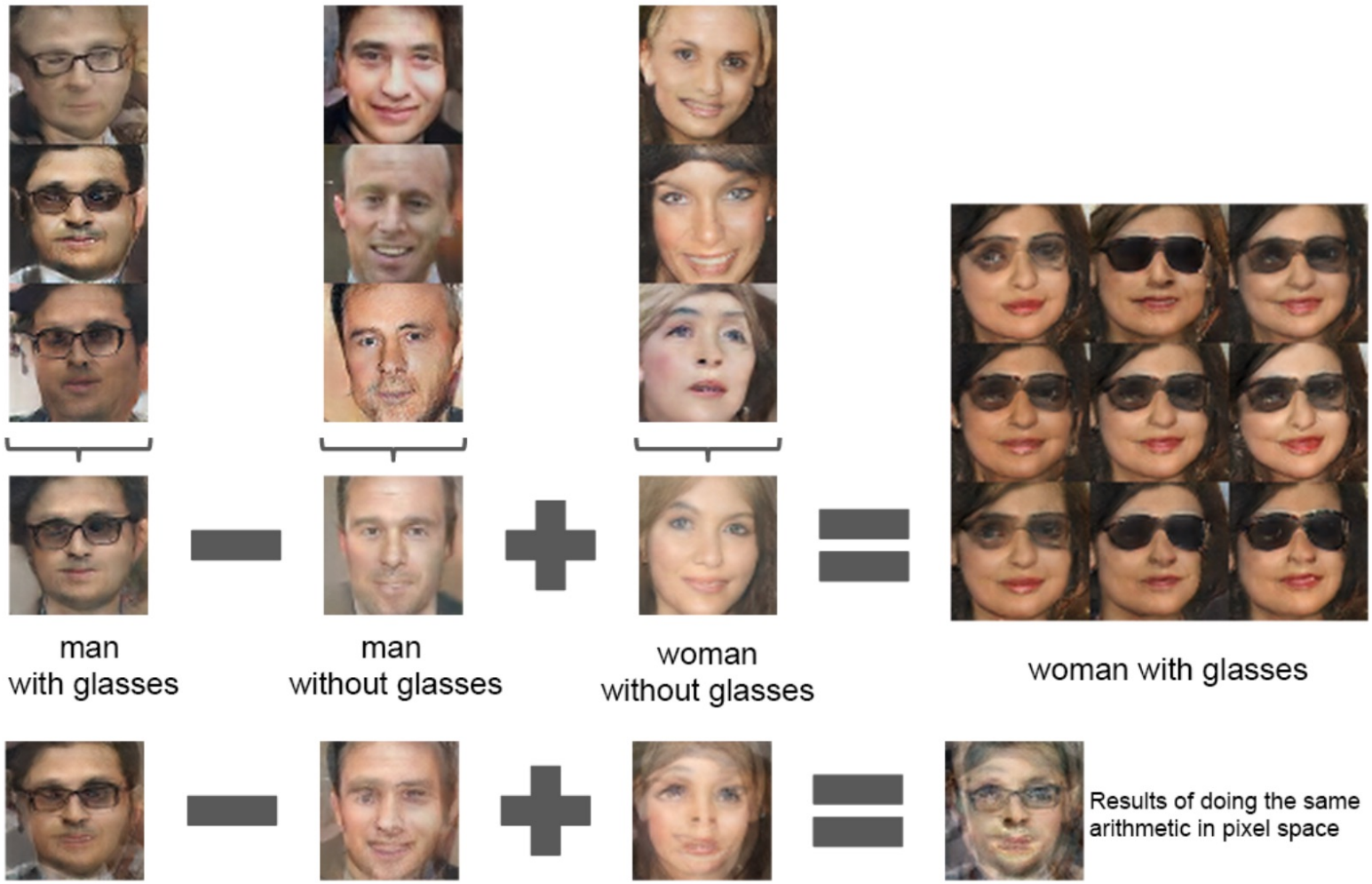
(a) Generated by LSGANs.

(b) Generated by DCGANs (Reported in [13]).

Figure 5: Generated images on LSUN-bedroom.

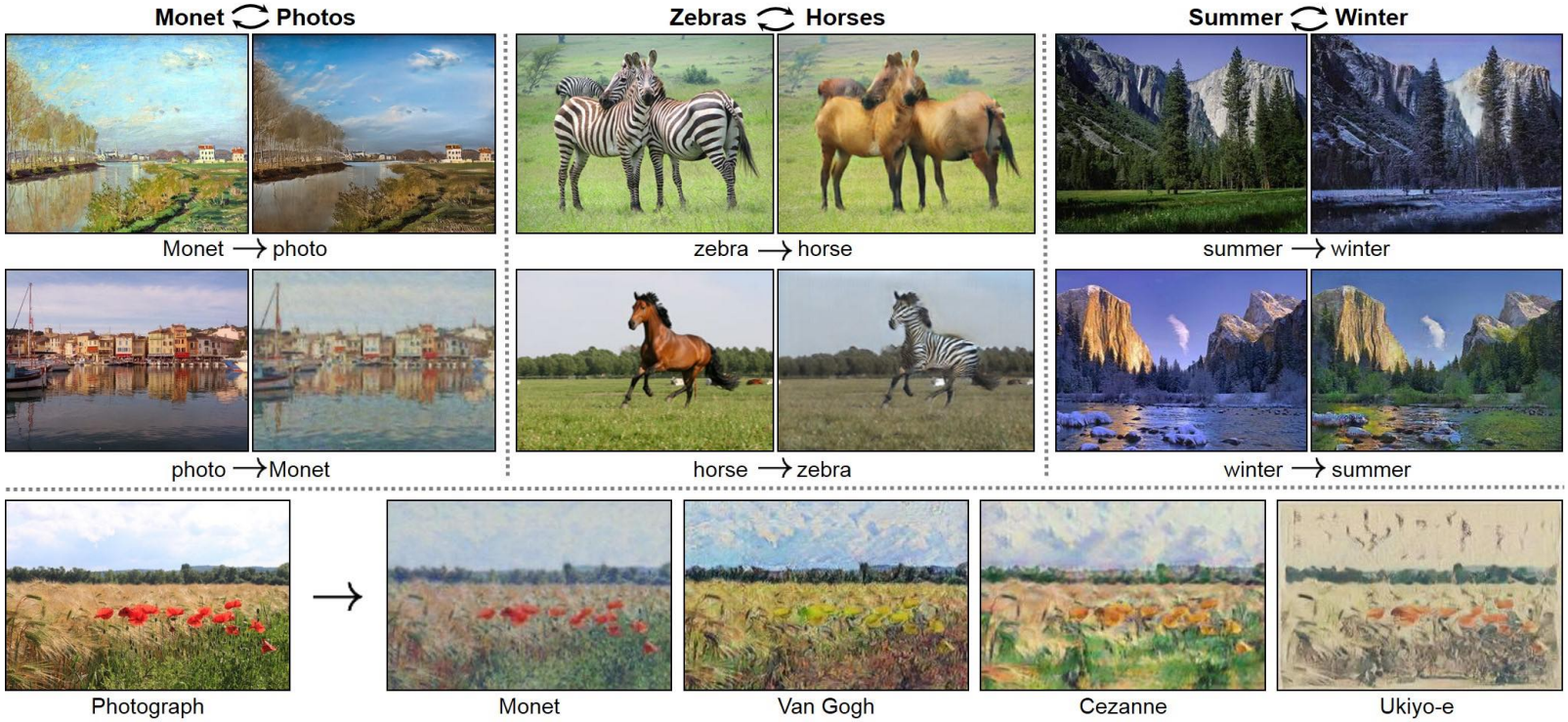
DCGANs

Radford et al. (2016)



CycleGANs

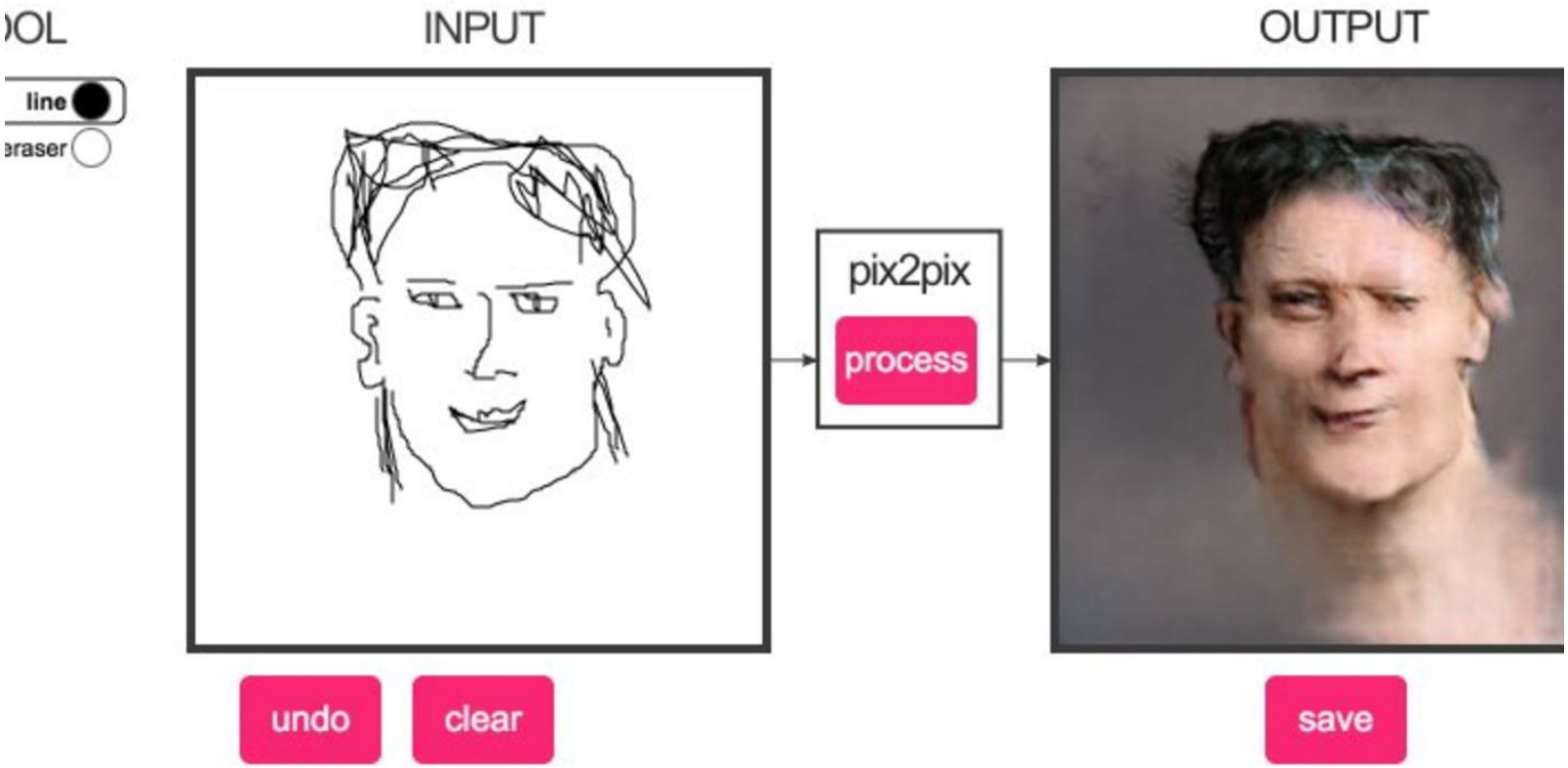
Zhu et al. (2017)



https://junyanz.github.io/CycleGAN

pix2pix

Isola et al. (2017)



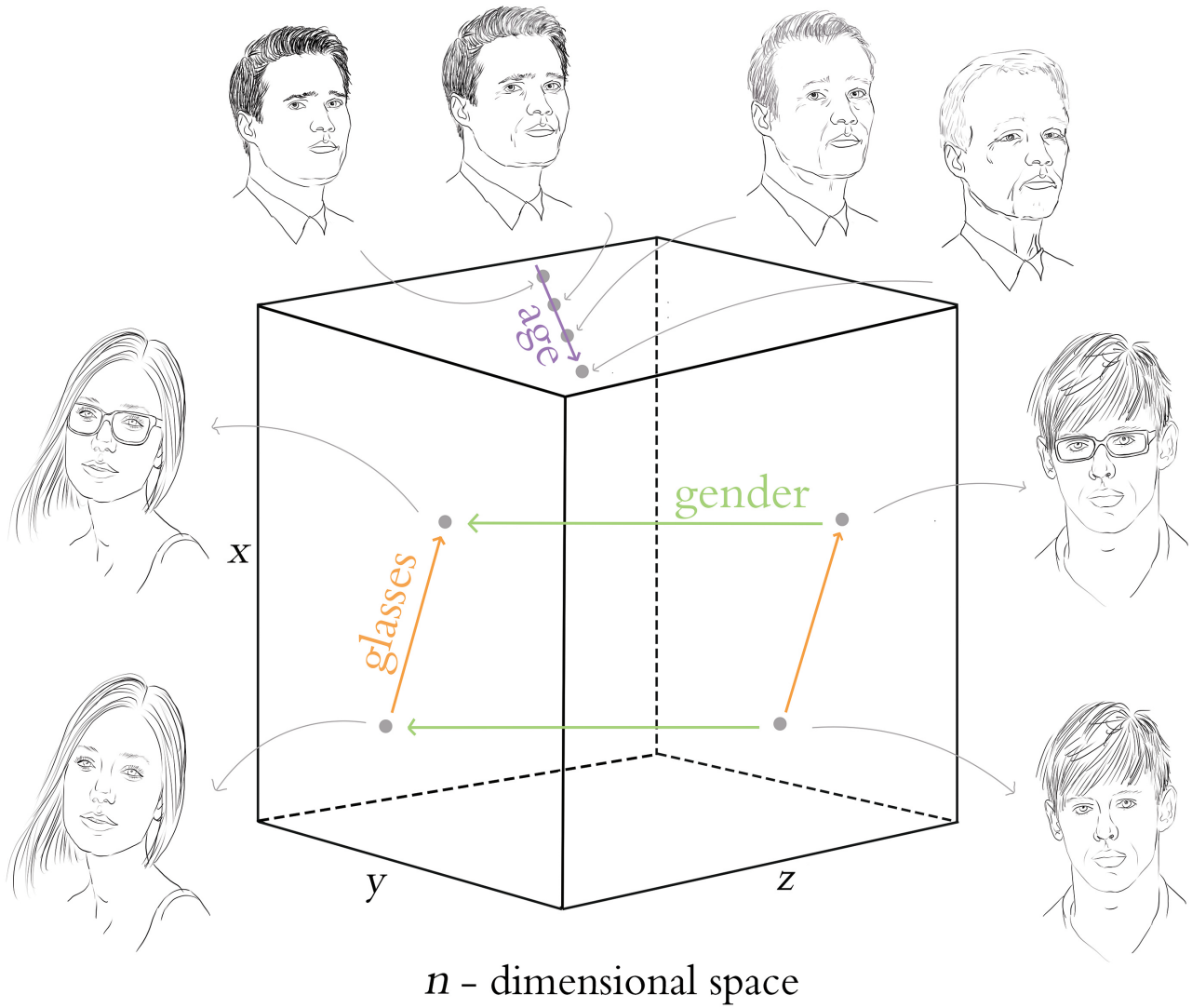
https://affinelayer.com/pixsrv/

StackGAN

Zhang et al. (2017)

Figure 3. Example results by our proposed StackGAN, GAWWN [20], and GAN-INT-CLS [22] conditioned on text descriptions from CUB test set. GAWWN and GAN-INT-CLS generate 16 images for each text description, respectively. We select the best one for each of them to compare with our StackGAN.

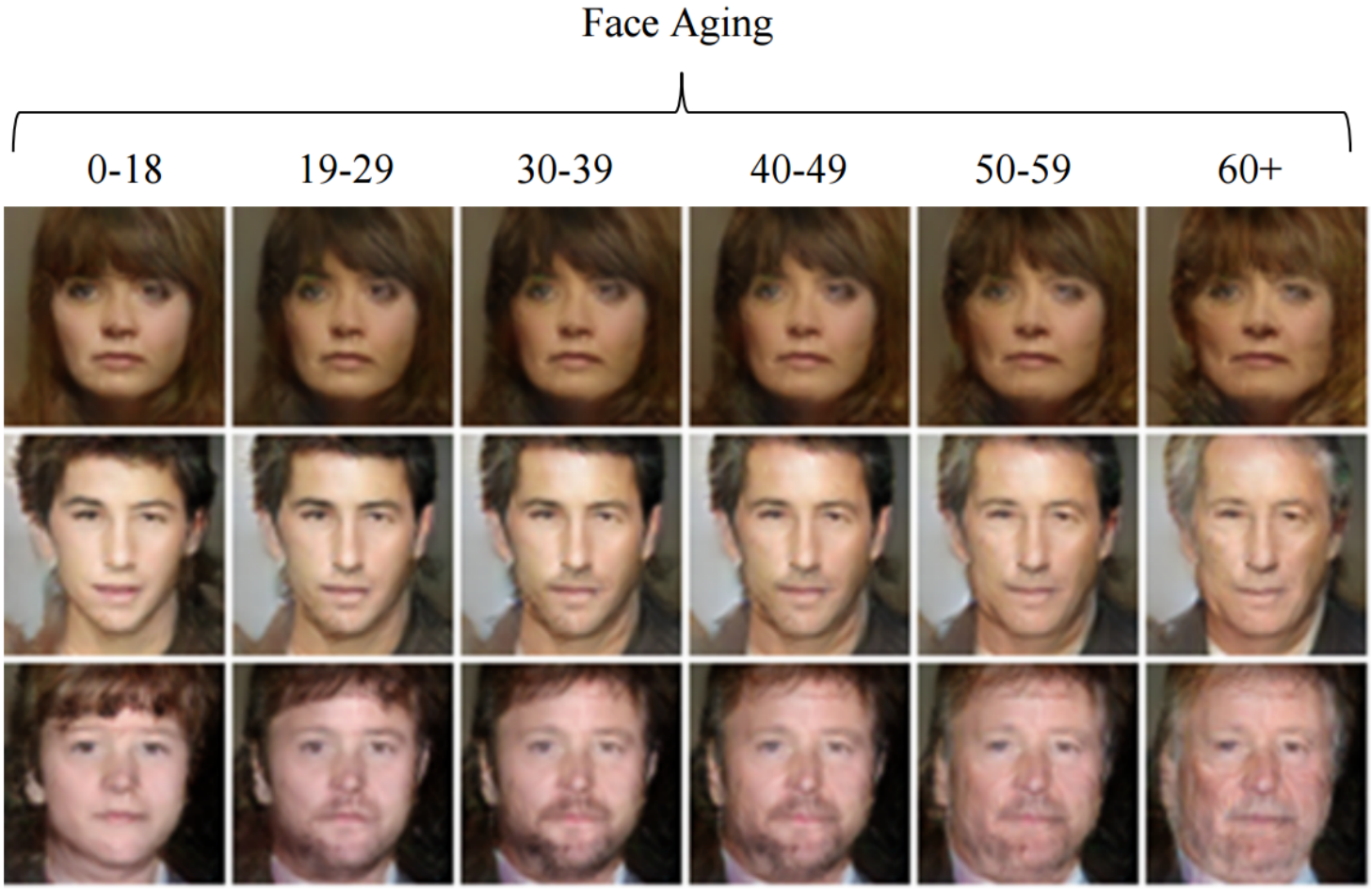
[Which Face is Real?]



["celebrity" latent-space interpolation]

[Mona Lisa frown]

Latent-Space Interpolation



Jon Krohn

[Ganvatar interactive demo]

Use Cases

- [make $ selling art :)]
- increase the resolution of an image
- simulate data, e.g., for training autonomous vehicles
- predict next frames of video
- speed fashion/architectural design (sketches to photorealism)
- edit images with realistic, nuanced changes
- [artificial intelligence augmentation (AIA)]
- also can generate time series like text, prices, audio

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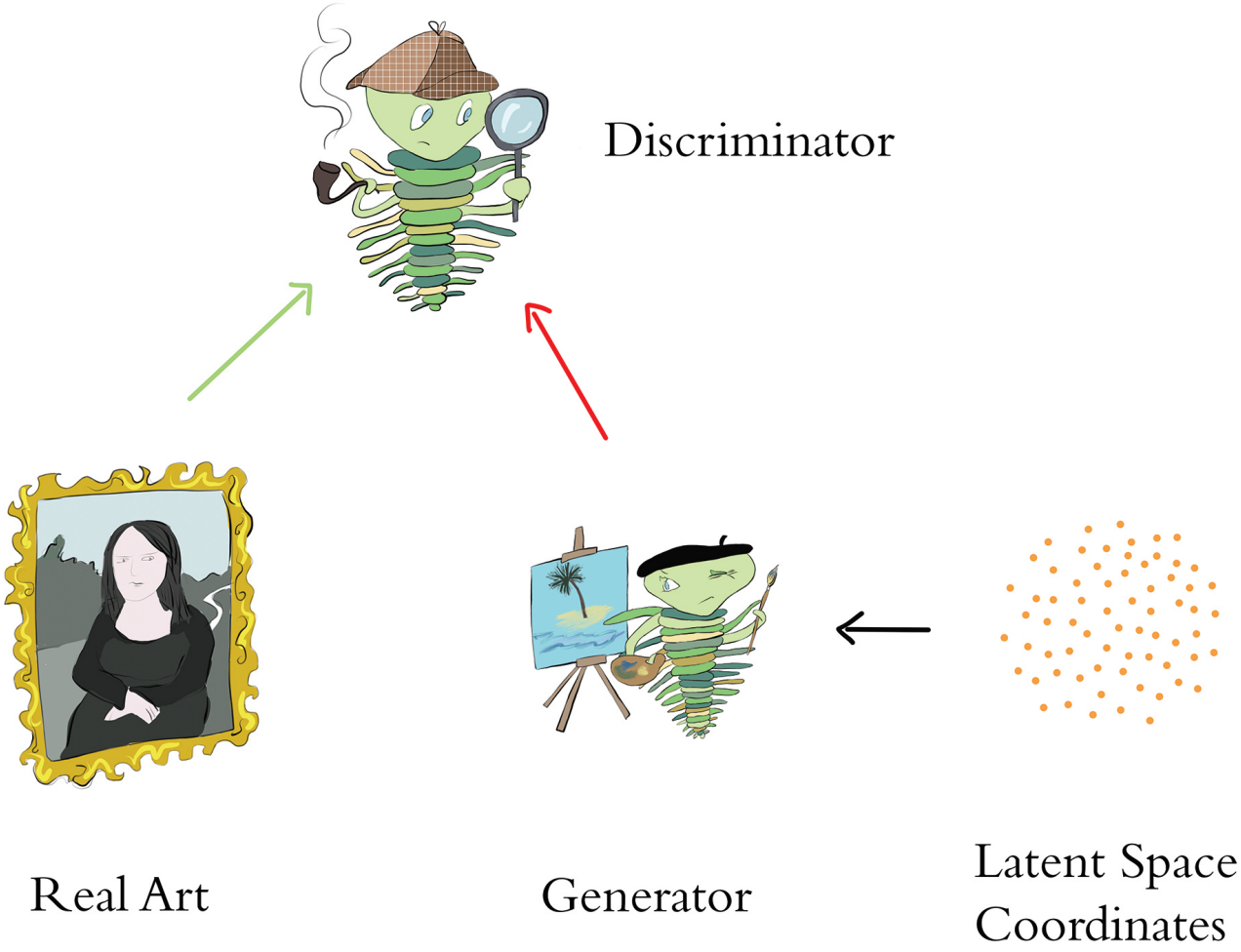
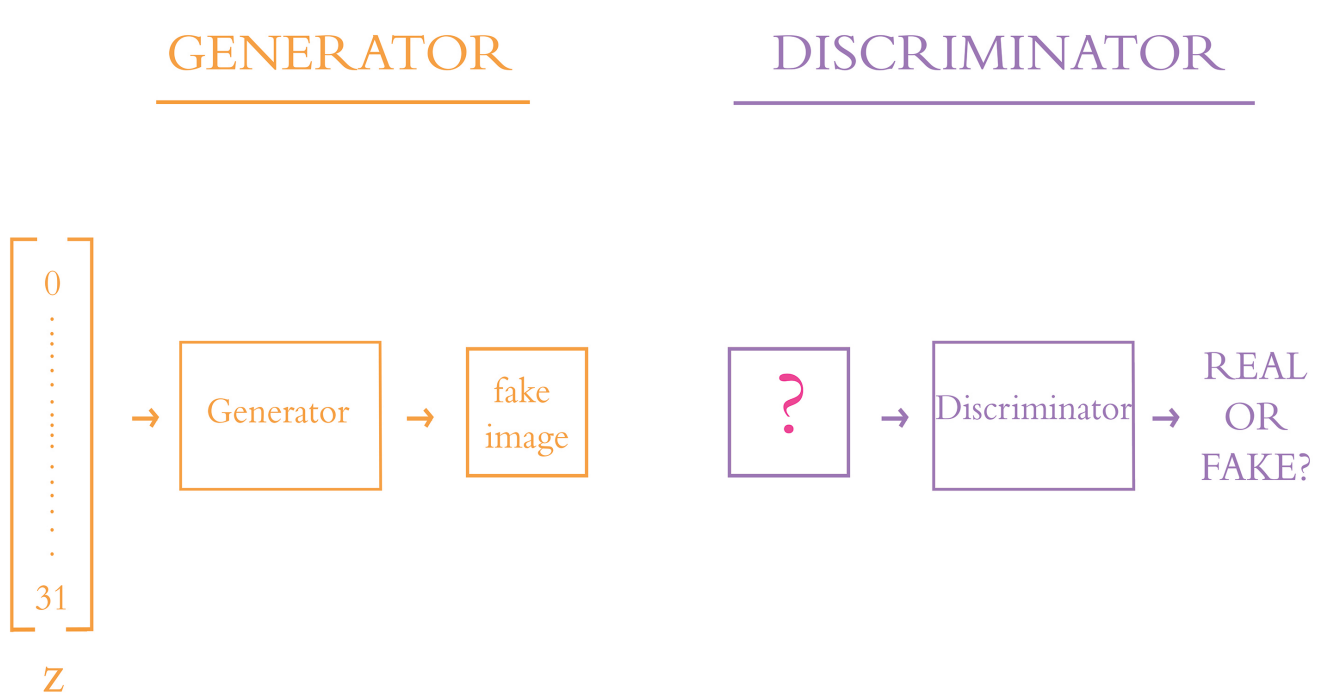
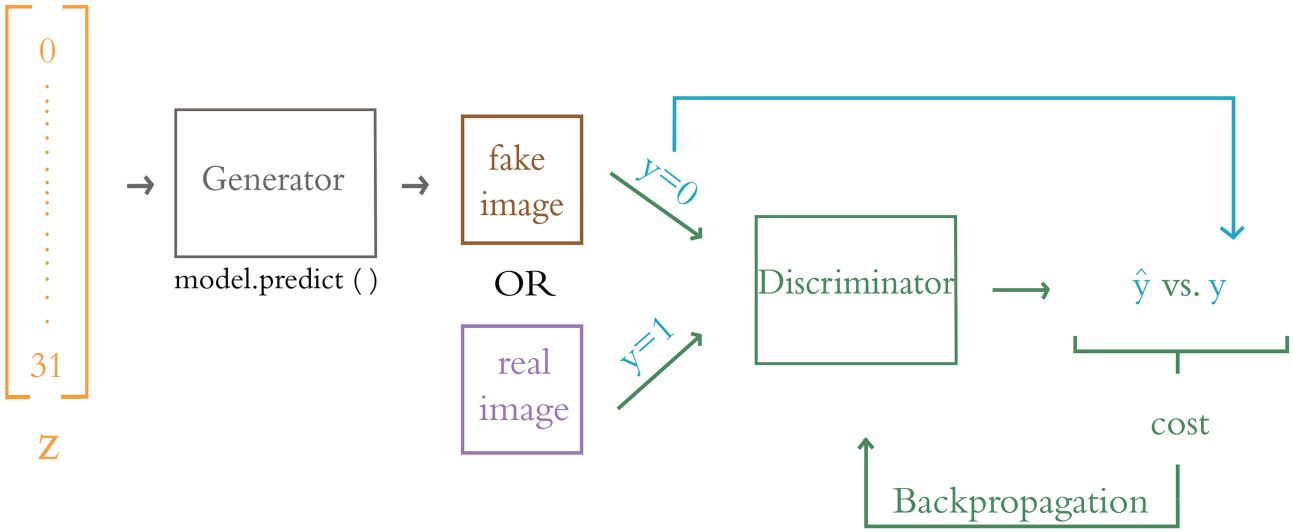
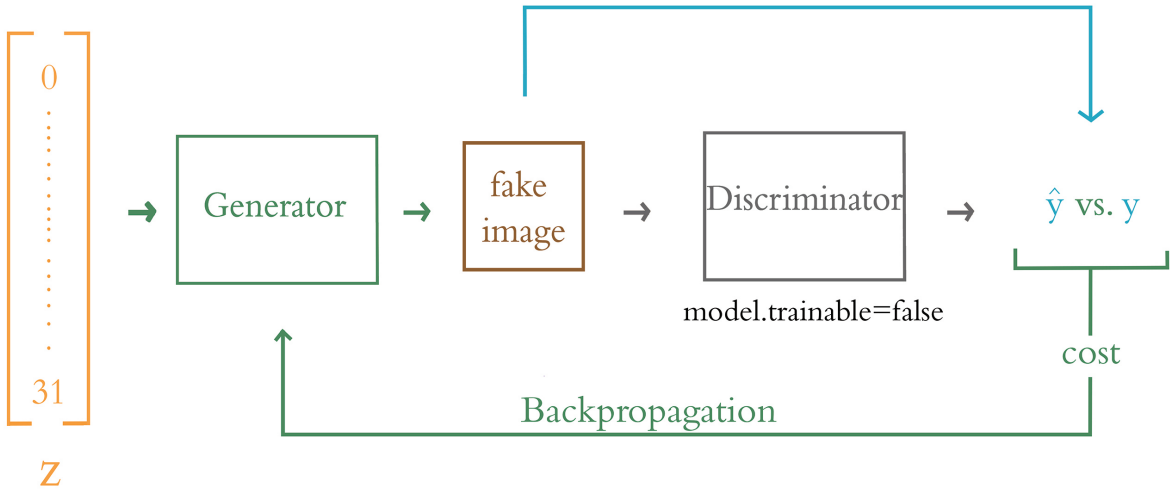

Discriminator
Real Art
Generator
Latent Space Coordinates

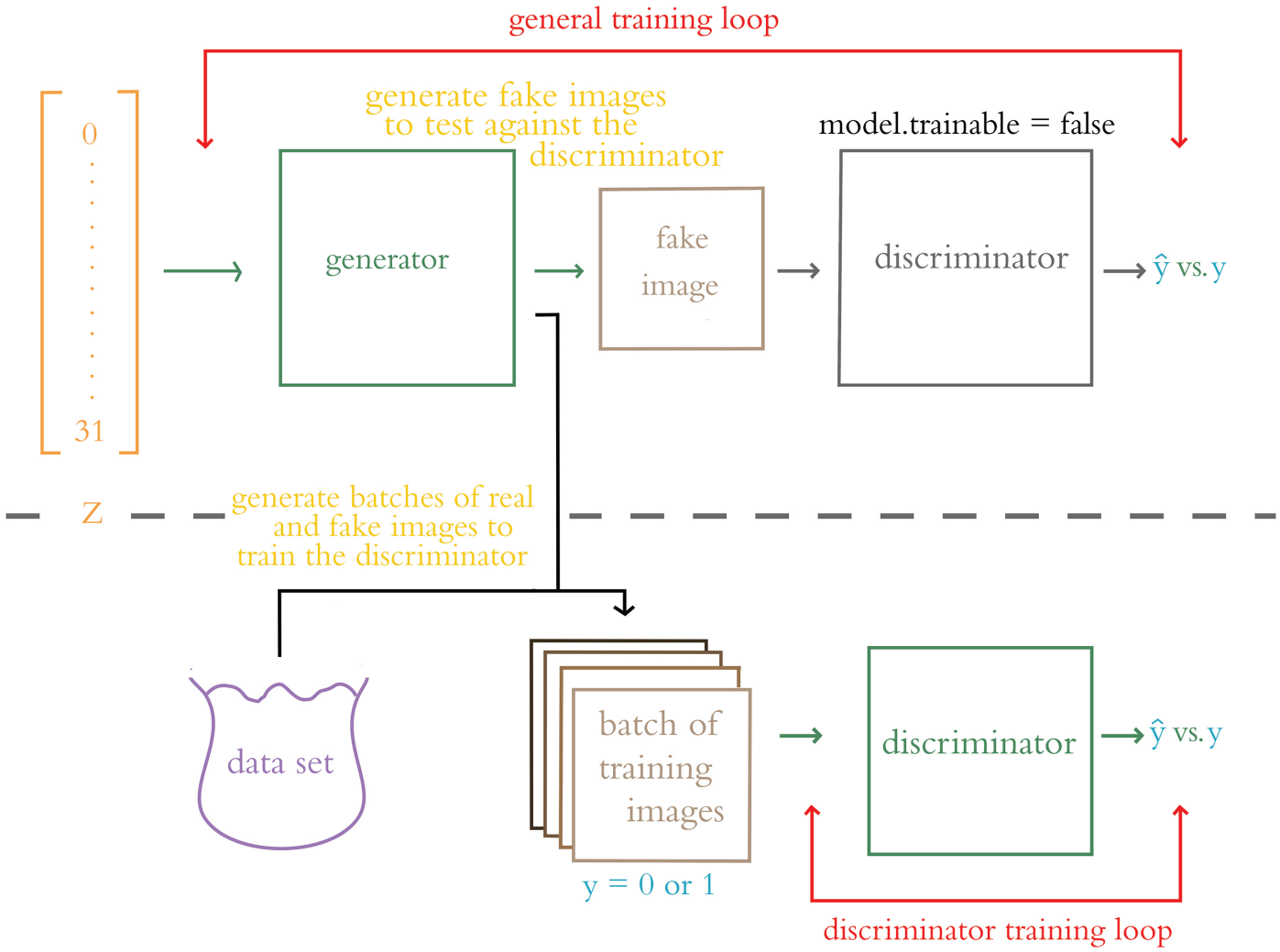

GENERATOR
DISCRIMINATOR
0
31
z
Generator
fake image
?
Discriminator
REAL OR FAKE?

TRAINING THE DISCRIMINATOR



TRAINING THE GENERATOR




general training loop
generate fake images to test against the discriminator
model.trainable = false
0
31
z
generator
fake image
discriminator
ŷ vs. y
generate batches of real and fake images to train the discriminator
data set
batch of training images
y = 0 or 1
discriminator
ŷ vs. y
discriminator training loop

1-D Gaussian

Approximating a Toy Distribution

[video]

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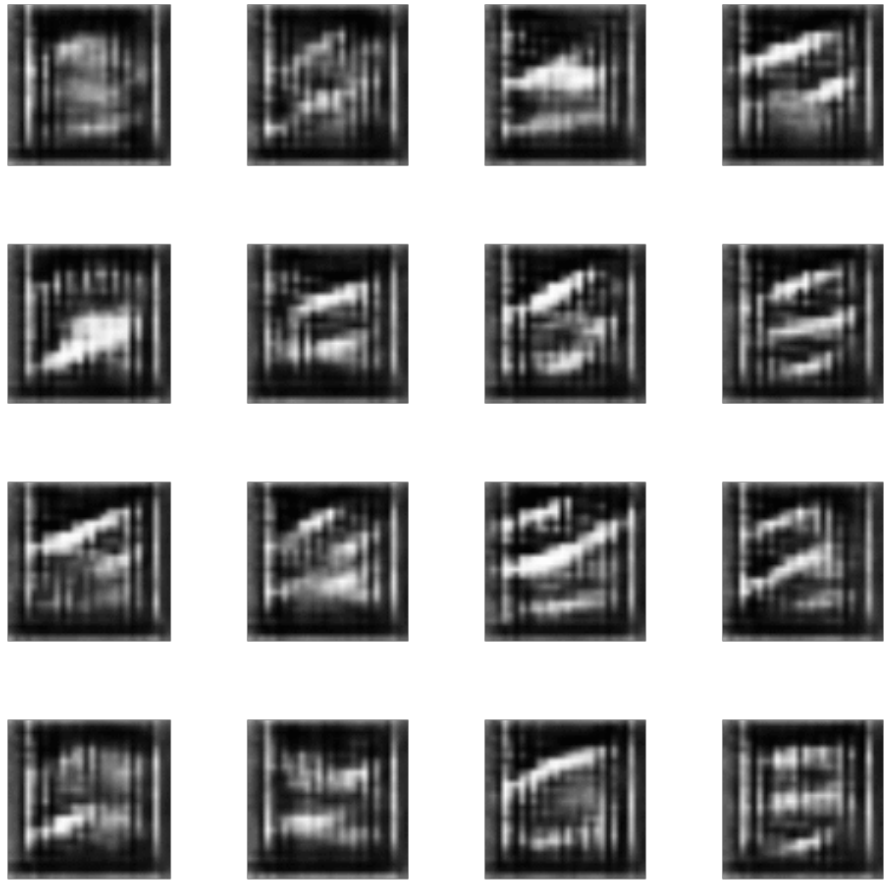
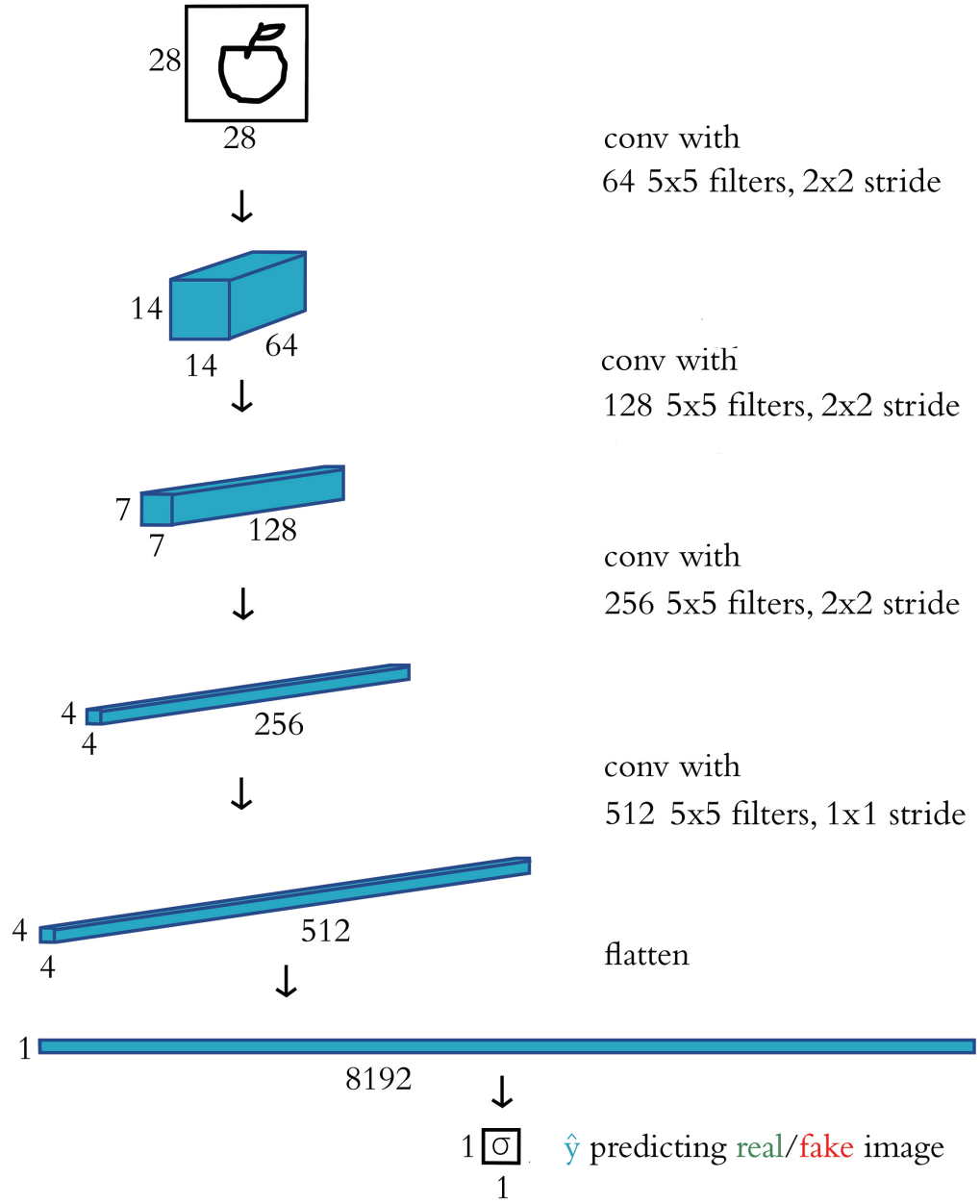
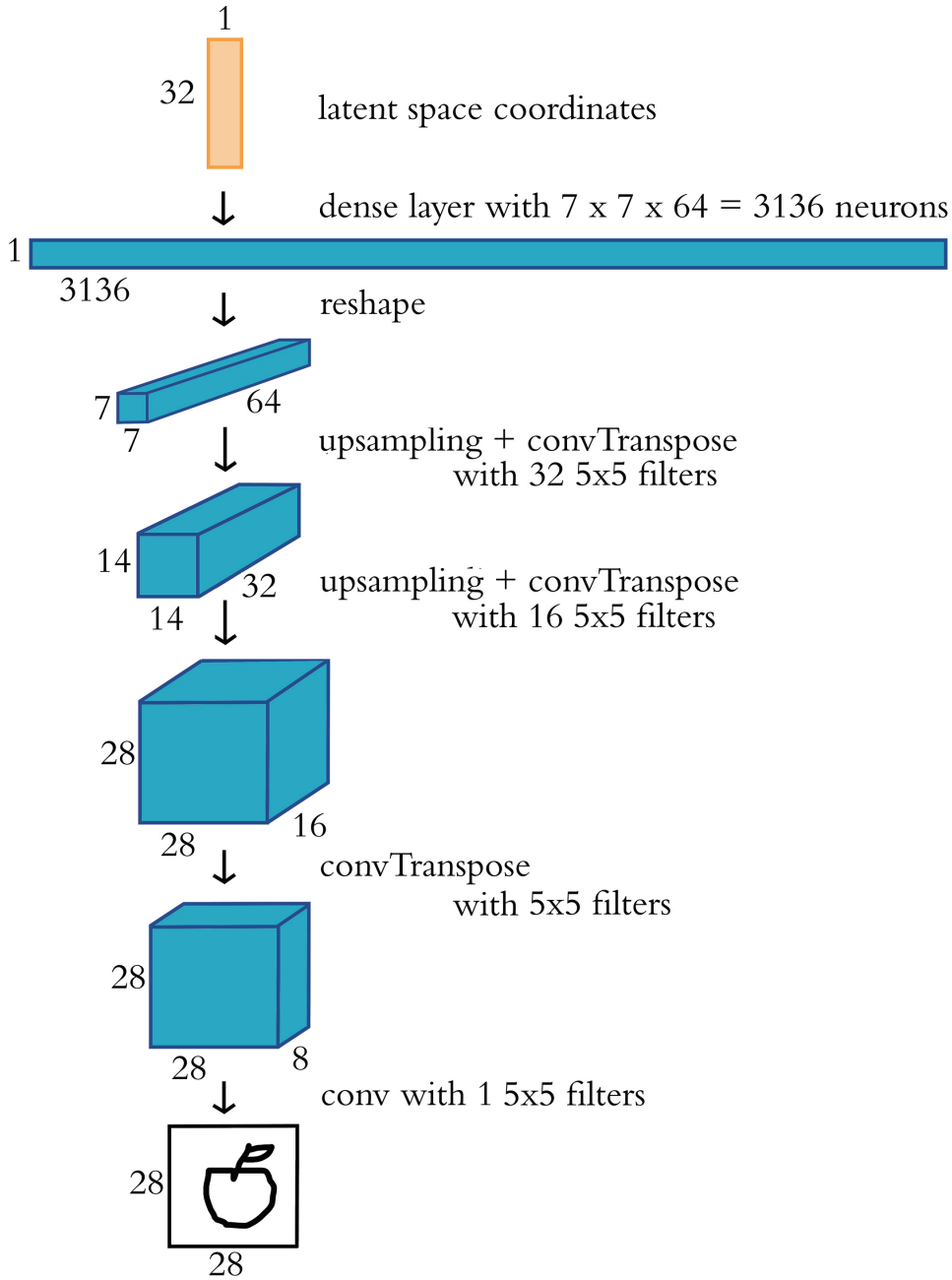
[Quick, Draw!]

GANimation

(Requires Adobe Acrobat Reader)




28
28
conv with
64 5x5 filters, 2x2 stride
14
14
64
conv with
128 5x5 filters, 2x2 stride
7
7
128
conv with
256 5x5 filters, 2x2 stride
4
4
256
conv with
512 5x5 filters, 1x1 stride
4
4
512
flatten
1
8192
1
σ
1
ŷ predicting real/fake image


1
32
latent space coordinates
dense layer with 7 x 7 x 64 = 3136 neurons
1
3136
reshape
7
7
64
upsampling + convTranspose
with 32 5x5 filters
14
14
32
upsampling + convTranspose
with 16 5x5 filters
28
28
16
convTranspose
with 5x5 filters
28
28
8
conv with 1 5x5 filters
28
28

GAN Code

[notebook]